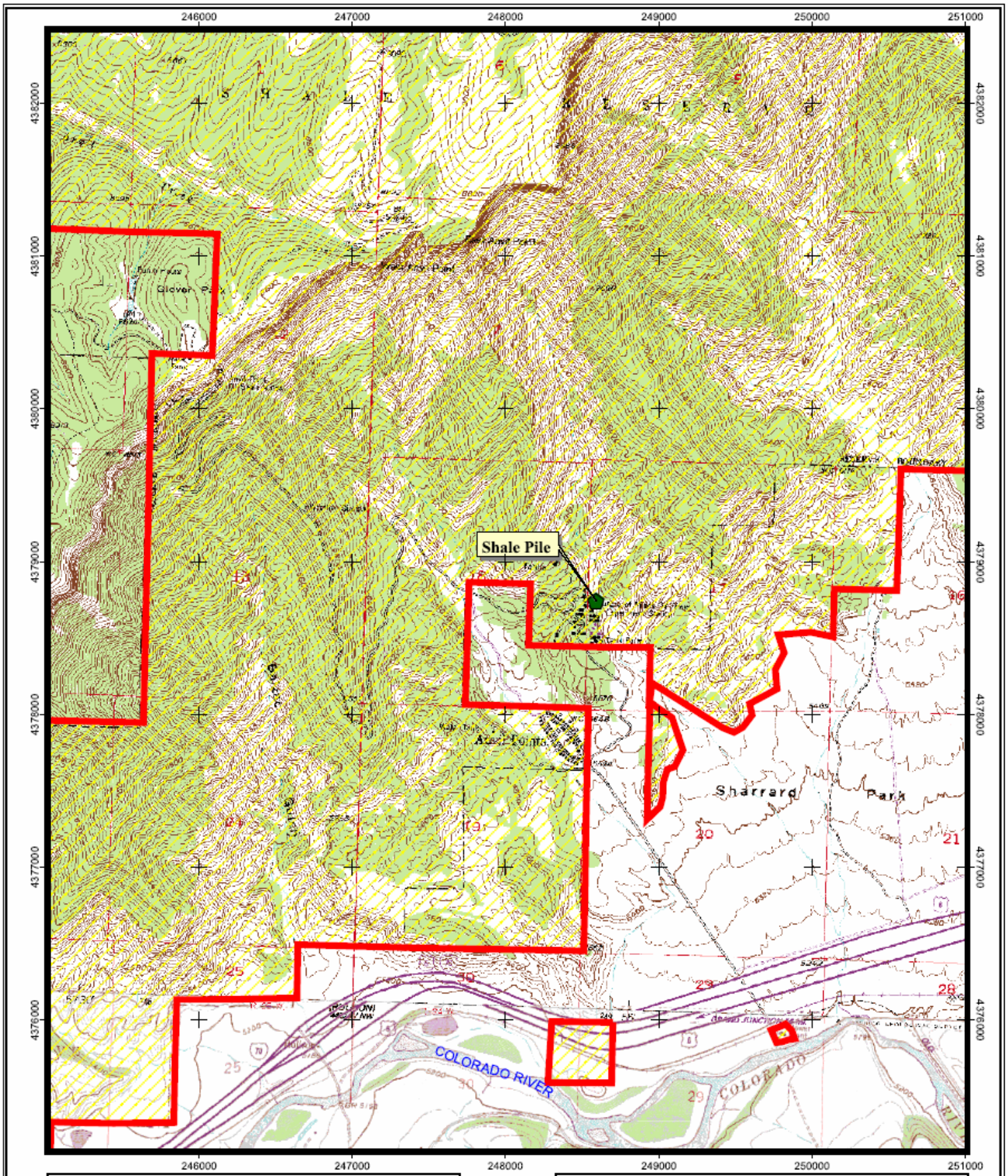
2 Site Description and Background

2.1 Site Location

The APF is located within the boundary of Naval Oil Shale Reserve (NOSR) Number 3, approximately 7 miles west of Rifle, Colorado in Section 17, T6S, R94W, 6th PM (Latitude 39° 31' 15"N, Longitude 107°55' 00"W). The site location is shown in Figure 2-1. The APF occupies approximately 365 acres within the NOSR Number 3, which has a total area of 20,171 acres. The site is located within the rugged highland country of western Colorado and is comprised of semi-arid land in the southeast Piceance Creek basin. Elevations range from 5,500 feet near the Colorado River to 9,000 feet above sea level at the top of the Roan Cliffs. Access to the site from Grand Junction is gained by traveling approximately 49 miles east on Interstate 70 to the Rulison exit. From the Rulison exit, proceed on the frontage road east for 4 miles, and then north approximately 2 miles on the Garfield County landfill access road.

2.2 Type of Facility and Operational Status

The APF was constructed to pioneer oil shale mining, processing and development by government and private industry. Development of the site was initiated in the spring of 1945 by the U.S. Bureau of Mines. Construction of the first retorts and the installation of the crushing and screening equipment were completed by the spring of 1947. Operations using a number of different oil shale processing techniques were conducted at the site between 1947, when the first batch of oil shale was retorted, to July 1955, when the APF was shut down due to the expiration of the Synthetic Fuels Act. Between 1956 and 1964, the APF was inactive with only minimal workers on site to maintain the facility. Experimental oil shale production operations were restarted by the Colorado School of Mines Research Foundation, which leased the APF between 1964 and 1968, when operations ceased again. In 1972, Development Engineering, Inc., a subsidiary of Paraho



Legend

- BLM Lands (approximate)
- Shale Pile Location

Scale 1:20,000

200 0 200 400 Meters

ecology and environment, inc.
International Specialists in the Environment

Anvil Points Facility
Location Map

Project 5624-100	Date 06/04	Figure 2-1

P:\Projects\BLM Anvil Points 5624\GIS Data\Anvil Remake.apr

Corporation, leased the APF and operated the facility intermittently between 1973 and 1982, when their lease expired.

Between 1947 and 1982, approximately 400,000 cubic yards of oil shale were mined and processed at the APF. By 1983, private sector interest in oil shale research waned and the facility was placed in standby mode.

In 1984, the Department of Energy (DOE) decided to decommission the facility and in 1986, decommissioning and demolition was concluded. In 1997, Congress transferred administrative jurisdiction of NOSR 3 from the DOE to the Department of Interior, BLM.

The shale pile and impoundments that are included within the scope of this EE/CA are further described below.

2.2.1 Shale Pile

Spent (retorted) shale and raw shale fines (excluded from the retorting process) were disposed of from the Plant Site at the top of the bench west of West Sharrard Gulch onto the steep slope descending to the gulch (Figure 2-2). The waste shale pile extends for approximately 900 feet along the terrace bench above the gulch, and is 150 feet high at its highest point. The surface of the shale pile has a slope of about 1.4:1, and contains several areas of material sloughing. The course of West Sharrard Creek was altered to make additional space for the spent shale pile and for construction of several spent shale process lagoons. During plant operations, retort wastewater was disposed on the shale pile (NEESA 1985). Water and wastewater flowing through the shale pile have probably leached soluble salts and organic compounds, which may have entered ground water or seeped into West Sharrard Gulch (NEESA 1985).

Figure 2-2: View of the Shale Pile in 2003, looking to the south

The raw shale fines and spent shale piles eventually merged. A fire (*in-situ* combustion) was observed in the pile of raw shale fines in 1978, later attributed to residual heat from

the retorted shale (Lavery 1985). High temperatures (approaching 500°C), and cracking and venting of hot gases were observed for several years. The waste shale pile reportedly burned until it was extinguished in the late 1980s or early 1990s.

2.2.2 Impoundments

Industrial waste treatment ponds have been present in West Sharrard Gulch since the start of operations at the APF (NEESA 1985). Two groups of three ponds were constructed. Figure 2-3 shows the historic location of the ponds relative to the shale pile and the industrial waste line system to the ponds. Three waste treatment ponds remain: the Upper Process Pond (also called Primary Pond), Overflow Pond (which was originally divided into two ponds), and the Relic Pond (Buried Pond).

Upper Process Pond

Since the beginning of operations at the APF, the Upper Process Pond received acid from the acid treatment facility, waste acid from the laboratory, refinery waste, oil from the tank farm, boiler blowdown, and retort wastewater. The waste acid was pretreated in two small pits west of the pond prior to discharge. The industrial wastes passed through a skim pit. Historic photographs also show a spray evaporation system operating at this pond, and several steel tanks present on its southern margin. The purpose of these tanks is unknown; possibilities include oil-water separators or pre-treatment of acids. The Upper Process Pond was unlined until it was re-built in the mid-1970s (NEESA 1985). In response to releases of oil from the *in-situ* retorting in the shale pile in 1979, oil was diverted to the Upper Process Pond, which was an engineered and lined disposal pond.

Overflow Pond

The Overflow Pond is situated immediately south of the Upper Process Pond. Photographs taken during site operations show it as being unlined and originally divided into two cells. These ponds were reportedly used only a few times during operations at the APF.

Relic Pond

The Relic Pond (also known as the Buried Pond) was the original pond below the shale pile and was covered over as the shale pile grew. Prior to 1950, the Relic Pond received boiler blowdown. This pond was at least partially excavated when, in 1979, spent shale encroaching on West Sharrard Creek was bulldozed back up against the shale pile, forming the bench currently present near the toe of the shale pile.

Other Ponds

NEESA (1985) identifies two “Test Ponds” southeast of the Relic Pond (labeled Pond 1 and Pond 2 in Figure 2-3). They describe these ponds as having, along with the Relic Pond, received drainage from the shale piles, boiler blowdown, retort washwater, and

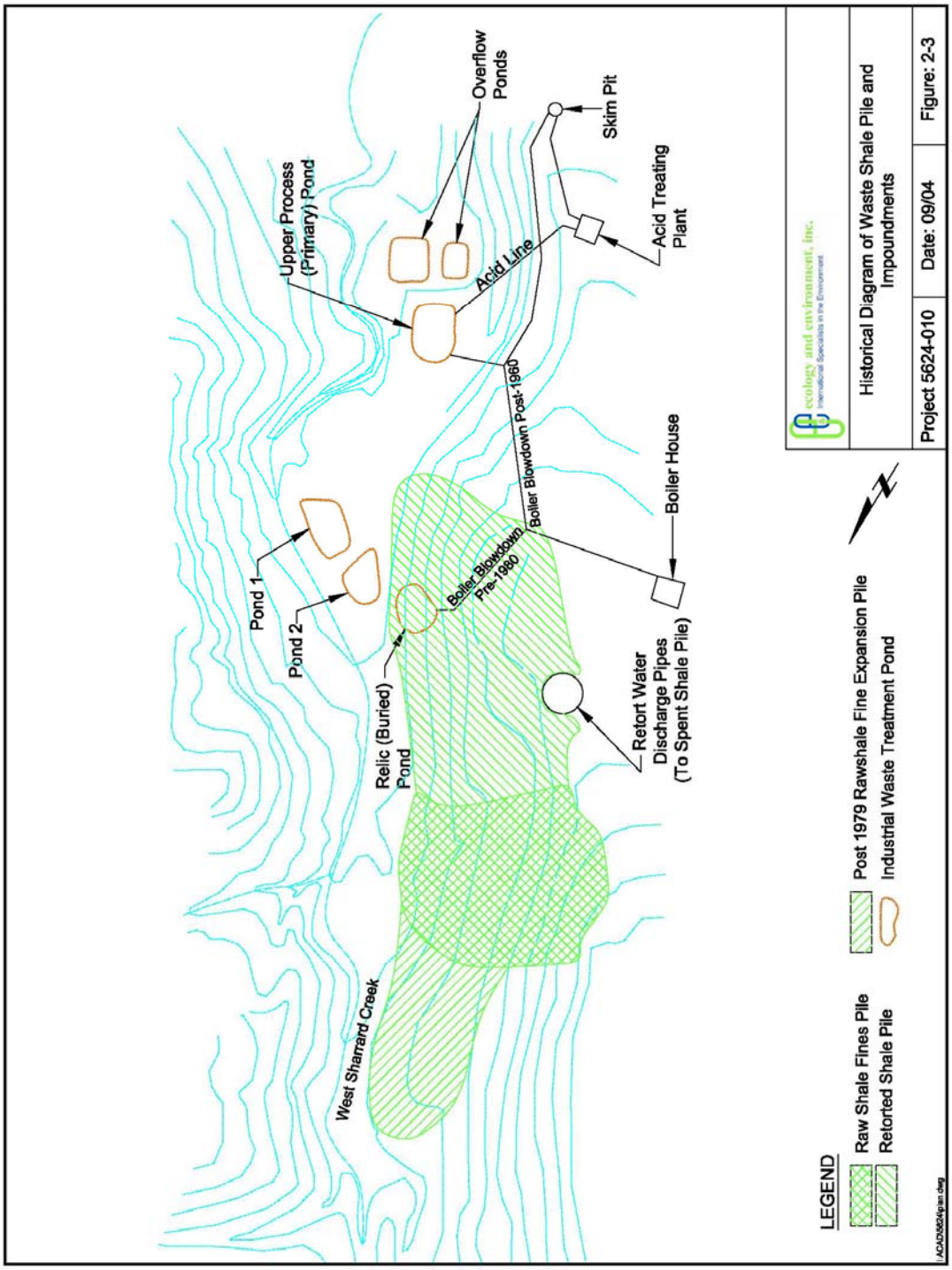


Figure 2-3: Diagram of the Waste Shale Pile and Treatment Ponds (from NEESA 1985)

runoff from the Plant Site. They are described as having been filled with retorted shale, with drainage routed around them. Compaction and lining tests are listed as having been conducted on these ponds in the mid-1970s before they were filled.

2.3 Structures and Topography

2.3.1 Structures

The Plant Site is not within the scope of this EE/CA but contained numerous structures, which were largely demolished by 1986. The only structure remaining within the shale pile and impoundments is a pipe leading from the boiler house and/or the acid treating plant leading to the Upper Process Pond or Relic Pond.

2.3.2 Topography

The APF is located between 5,800 and 6,000 feet above mean sea level and approximately 600 to 800 feet above the Colorado River floodplain. The spent shale pile is located within the steep-sided West Sharrard Gulch, which begins on the lower slopes of the Roan Cliffs. The top of the Roan Cliffs are several thousand feet above the Colorado River (NEESA 1985). The Roan Plateau and Roan Cliffs were formed from the uplift of several thousand feet of sedimentary rock. Over 5,000 feet of erosion has occurred since then (Yeend 1969), creating the steep cliffs and canyons that characterize the area. Below the APF, Sharrard Park is an alluvial fan formed at the base of West Sharrard and Balzac Gulches.

The APF shale pile is approximately 900 feet long and 150 feet high and consists of processed and raw oil shale fines that were deposited from the top of a steep slope within West Sharrard Gulch. The shale fines were not compacted after dumping. A topographic survey of the shale pile was conducted using a Global Positioning System (GPS) unit capable of accuracy to within 1/100th of a foot. Measurements were taken to define the oil shale piles and grade changes and to define the topography of the existing native slopes surrounding the shale pile. Approximately 1,050 points were surveyed on the pile, impoundments, and east and south of the pile (Frontier 2004). A topographic map of the shale pile and impoundments is shown in Figure 2-4.

2.4 Geology and Soils

2.4.1 Geology

The APF is located in the southeastern portion of the Piceance Creek Basin. Local surface geology is composed of early Tertiary sedimentary formations (deposited 65-38 million years ago) and Quaternary formations (deposited less than 3 million years ago). The Eocene Uinta Formation forms the top of the plateau above the APF and contains sandstones and siltstones. Underlying the Uinta are the Parachute Creek and Anvil Points members of the Eocene Green River Formation. These units form the Roan

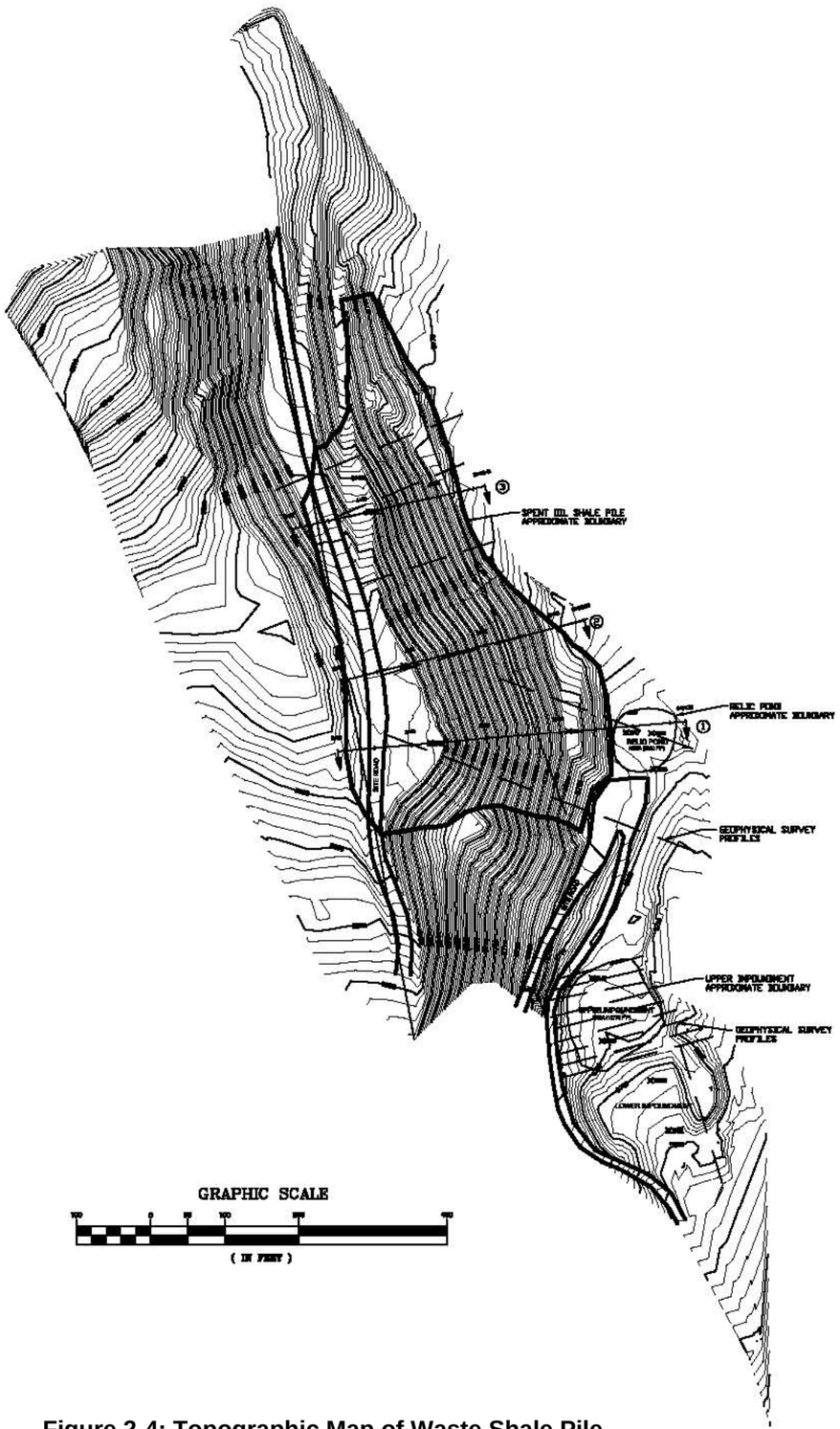
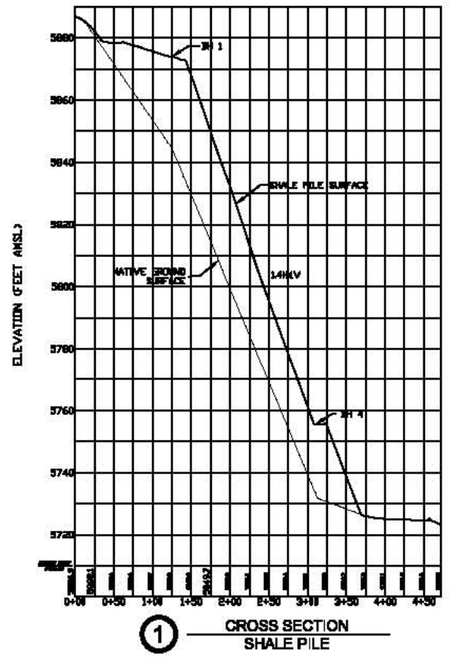
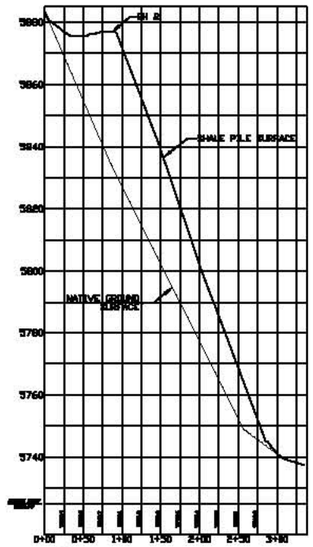


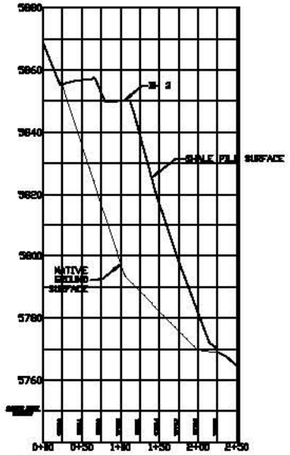
Figure 2-4: Topographic Map of Waste Shale Pile



1 CROSS SECTION SHALE PILE



2 CROSS SECTION SHALE PILE

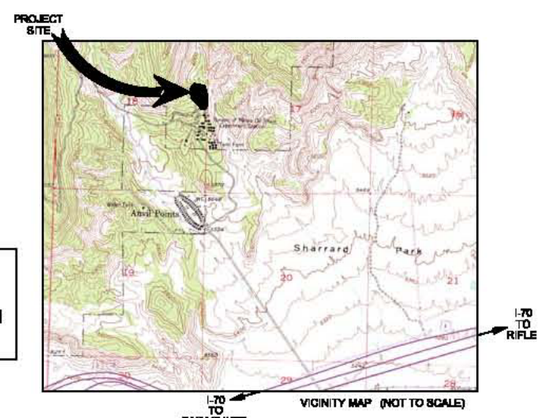


3 CROSS SECTION SHALE PILE

NOTES:

1. VOLUME OF THE PILE CALCULATED = 108,000 CUBIC YARDS
2. VOLUME OF PILE WITH 20% ESTIMATED FACTOR = 130,000 CUBIC YARDS
3. SLOPE STABILITY FRICTION ANGLE = 25 DEGREES
4. PRESENT SAFETY FACTOR FOR SLOPE STABILITY - 0.6 TO 0.9
5. SAFETY FACTOR REQUIRED 1.3 TO 1.5
6. RECOMMEND RUN-ON STORMWATER CONTROL CHANNELS
7. RECOMMEND SLOPE OF 3:1 OR LESS OF UNCOMPACTED WASTE
8. RECOMMEND SLOPE OF 2:1 OR LESS IF WASTE IS COMPACTED TO 95% OF MAX. DRY DENSITY
9. CURRENT SLOPE OF 1.4:1

11"x17" DRAWING FOR ILLUSTRATION PURPOSES ONLY
SEE 24"X36" DRAWING FOR ENGINEERING SCALE AND DIMENSION



VICINITY MAP (NOT TO SCALE)

Cliffs and contain oil shale, marlstone, siltstone, sandstone, and limestone. Underlying the Green River Formation is the Paleocene-Eocene Wasatch Formation. It forms the lower portion of the Roan Cliffs and is exposed on the ridges and mesas southward to the Colorado River. The Wasatch is comprised of interbedded clays, mudstones, sandstones, and conglomerates. The sandstones are predominantly channel deposits and are laterally discontinuous. Quaternary alluvium flanks the Colorado River. The strata at the APF generally dip slightly to the west (NEESA 1985). The oil shale mined and processed at the APF is from the Mahogany Ledge Unit of the Parachute Creek Member of the Green River Formation. The Mahogany Ledge Unit in this area is approximately 70 feet thick.

West Sharrard Gulch traverses an area composed mainly of unconsolidated colluvial and alluvial deposits that tend to interbed and form gradual contact zones with one another. The alluvium varies in thickness from the upper to lower reaches of the gulch, with a maximum thickness of about 40 feet below the APF. The alluvium is a poorly sorted mix of clay, silt, sand, cobbles, and boulders with minor inclusions of well-sorted lenses of sand and sandy gravel (Dynamac 1998).

2.4.2 Soils

Soils are variable across the APF. The top of the Roan plateau is covered by the Parachute-Rhone-Irigul soil series. These soils are well drained, deep to shallow loams and sandy-clay loams on mountain slopes and ridges (RMC 2004). Below the rim of the plateau are Rock Outcrop-Torriorthents soils. These soils include rock outcrops on the steep areas and residual clays and loams derived from the underlying Wasatch sandstoneand shale. These soils often contain high amounts of pebbles and cobbles. The Torriorthents-Rock Outcrop-Camborthids series is located along the southern and northeastern base of the plateau. These soils are similar to the previous series, but also contain clayey soils in alluvial fans at the base of the plateau.

2.5 Hydrology and Hydrogeology

2.5.1 Hydrology

There are three intermittent streams present within the APF: West Sharrard Creek, an unnamed creek to the west of West Sharrard Creek, and another unnamed creek in Balzac Gulch. All are tributaries to the Colorado River, and all are intermittent streams that flow less than three months out of the year; however, they are subject to frequent flash flooding. These streams all originate at the base of the Roan cliffs, and flow downward 3-4 miles before reaching the Colorado River. Gradients are high, and there is evidence of erosion and sediment transport as they pass through the APF. West Sharrard Creek is joined by another creek about the current location of I-70 and prior to reaching the Colorado River. This other tributary drains to a valley to the east of the APF, and would receive any surface water released from the Garfield County Landfill. Seeps are present below the shale pile and impoundments that drain into West Sharrard Creek.

The primary surface drinking water population would be within Parachute and Rulison, numbering between 4,500 and 5,000 people. Only a portion of their water is derived from the Colorado River, with most being sourced from surface water and springs south of the Colorado River, which would be unaffected by activities at the APF. Use of the APF property itself for future siting of residential homes, commercial businesses, or other industry is not expected (CDPHE 2000). Therefore, there is little chance of drinking water wells being installed on the APF site. However, we note that private land is present within and adjacent to the APF; therefore, development of these lands could occur in the future.

2.5.2 Hydrogeology

Several studies have characterized the general hydrologic conditions at the APF (NEESA 1985). Ground water is found within the alluvium of West Sharrard Creek and in the Green River Formation up gradient of the APF. Based on data from the existing ground water monitoring network, ground water flow in the alluvium is irregular in the vicinity of West Sharrard Creek and is poorly suited as a potable water source because of the poor water quality and limited storage.

Several aquifers exist in the Uinta Formation and upper member of the Green River Formation within the area delimited by the Roan Plateau. Several springs and seeps were noted by NEESA (1985), but "the water does not readily infiltrate into the less permeable rock formations below." NEESA noted that ground water movement in these formations follows local stratigraphic dip, which is to the northwest (i.e., away from the APF).

At the APF, shallow ground water tends to remain perched in the alluvium above the less permeable silty sandstone and shale layers of the Wasatch Formation. Due to the steep topographic gradient, seepage velocities are high. The off-site migration time was estimated to be days, at least to the point where ground water and surface water reaches the Sharrard Park alluvial fan (ORNL 1991). Ground water at the site varies from 14 feet below ground level (bgl) just east of the shale pile to 30 feet bgl at a location 150 feet south of the former Upper Process Pond.

There are no municipal ground water wells in Rifle, Rulison, or Parachute; these communities derive their drinking water entirely from surface water. Battlement Mesa has a ground water wellfield near the Battlement Mesa-Parachute Bridge that is used only as an emergency water supply, supplementing surface water. The wells are completed in shallow alluvium, and are considered drawing from "ground water under the influence of surface water" (personal communication with Doug Ayers, Battlement Mesa Metropolitan District 2004).

There are five permitted domestic water wells within 3 miles of the APF Plant Site. These wells are adjacent to or within 0.3 miles of the Colorado River and are completed

at depths ranging from 48 to 270 feet. Those nearest the Colorado River are presumably drawing from alluvium; those higher up on the valley floor may be drawing from bedrock.

As noted under separate cover in the SI report, no ground water was encountered during an attempt to install a ground water monitoring well in the southeast corner of the Plant Site. The boring was advanced to 160 feet, and no ground water was encountered (even after allowing the borehole to remain open overnight). The well was not completed.

2.6 Surrounding Land Use and Populations

The APF is located approximately 2 miles north of the Colorado River and Interstate 70 and 7 miles west of Rifle, Colorado. The BLM lands and surrounding private lands are currently undergoing an intensive natural gas drilling campaign targeting the subsurface Mesa Verde and Wasatch formations, and natural gas drilling and production is a primary land use in the area surrounding the APF. During drilling operations, each rig employs about 10 workers, working 24 hours per day. Estimates for the next year indicate that four drilling rigs will be used in Sharrard Park, which will employ 40 people (personal communication with Alan Kraus, 2004). One to three people will likely be employed in the area fulltime monitoring production from producing natural gas wells.

There are several industrial facilities located near the APF. At the former Paraho Development Company building near the Anvil Points town site, an oilfield service company, Cimmaron Oil and Gas Processing Equipment, Inc., has operations with three-four workers routinely present during working hours. Williams Energy operates a water evaporation facility next to the road about 1 mile south of the Plant Site and the Rulison Compressor Station south of the APF near I-70. Neither of these facilities is staffed continuously. The West Garfield Landfill, located 1 mile southeast of the Plant Site, has 14 employees and work crews present on a regular basis. Several businesses are located about 3 miles southeast of the APF including a pipe yard, construction materials yard, and a cement bulk loading facility.

The nearest home is located 1.1 miles east of the site in the next drainage east of West Sharrard Creek. A home has recently been constructed about 1.5 miles south of the Plant Site. There are also four homes about 3.5 miles southwest of the APF. The town of Rifle has a population of 6,700 people. A reasonable estimate of the maximum number of people that work or reside within 3 miles of the APF is 20-30, depending upon the number of drilling rigs operating in the area.

2.7 Ecological Resources

2.7.1 Vegetation Resources

The APF site comprises a topographic transect across the steep slopes of the Roan cliffs, from the top of the Roan Plateau in the northwest corner down to the toe of the cliffs at the eastern edge of the site. Vegetation patterns follow the temperature and moisture conditions that follow this elevation gradation. Throughout the site, particular combinations of substrate material, aspect, and topographical location create habitat for sensitive plant species. Mixed mountain shrublands occur along the top of the flat plateau. Just below the steepest, relatively unvegetated slopes along the upper cliffs, small pockets of mixed mountain shrubland occur with isolated aspen and Douglas firs.

The immediate vicinity of the shale pile was historically vegetated with pinyon-juniper woodlands interspersed with slopes of mountain sagebrush shrublands and occasional shale outcrops barrens. However, vegetation throughout the entire APF area has been seriously impacted through a number of human actions, including those associated with APF operations, as well as roads and well pads developed more recently for natural gas extraction. The results of these activities are large areas that have been cleared of woody vegetation and are now dominated by weeds and planted reclamation species.

The shale pile is bounded to the west and north by roads and cleared areas dominated by bare soil or patches of the noxious weed, cheatgrass (*Anisantha tectorum*), non-native reclamation grasses such as crested wheatgrass (*Agropyron cristatum*) and western wheatgrass (*Pascopyrum smithii*), and scattered native saltbush shrubs (*Atriplex* spp.). The bench terrace between the shale pile and the West Sharrard Creek gulch also supports these weedy and reclamation species with scattered Utah juniper (*Sabina osteosperma*) and pinyon pines (*Pinus edulis*) near the south end. The shale pile itself supports very little vegetation. The adjacent slopes are dominated by cheatgrass, with numerous shrubs, including saltbush, greasewood (*Sarcobatus vermiculatus*), rabbitbrush (*Chrysothamnus viscidiflorus*) and scattered Utah juniper. Areas of riparian wetlands occur along the three creeks that flow through the APF, just north of their relative confluences with the Colorado River. West Sharrard Creek traverses the eastern portion of the site. An unnamed creek bisects the center. The headwaters of the creek through Balzac Gulch are located in the western portion of the site. An additional 1,700 acres of riparian wetlands occur along the 15-mile long segment of the Colorado River downstream of the confluence with West Sharrard Creek. These areas provide important habitat for a number of bird species. The in-stream portions of this corridor provide crucial habitat for various fish species, including a number of sensitive species listed below, as well a number of waterfowl, wading birds, and shorebirds, some of which are also considered sensitive.

In the vicinity of the shale pile, the West Sharrard Creek floodplain was altered in the past when the creek bed was moved to make additional space for the spent shale pile and

process lagoons. The creek is usually dry, carrying water only in response to precipitation events, snow melt, and occasional interception of ground water. The stretch of West Sharrard Creek in the vicinity of the shale pile is deeply downcut, with steep banks that support sharse upland vegetation. Little vegetation occurs within the gulch, along the flow channel. No wetlands, nor riparian areas, exist in this reach of the creek.

2.7.2 Wildlife Resources

Much of the APF site lies within lands mapped by the Colorado Division of Wildlife (CDOW) as big-game winter range. Mule deer and American elk migrate seasonally from summer range on top of the Roan Plateau to winter range at these lower elevations. Throughout most of western Colorado, the availability of winter range is the limiting factor to big-game populations. Portions of lands along the southern edge of the APF site are denoted as big-game winter concentration areas, with some additional lands mapped as winter seclusion areas. Based on these distinctions, some timing limitations for protection of big-game resources are applied to these areas by BLM. Large carnivores that may occasionally move through the APF study area include black bears and mountain lions. Other potential predators in the APF vicinity include the bobcat, coyote, red fox, American badger, long-tailed weasel, short-tailed weasel, and mink. The coyote occurs throughout general area, while the similarly sized bobcat is mostly limited to rugged or wooded areas. The red fox, long-tailed weasel, and short-tailed weasel prefer mosaics of wooded and open terrain and are mostly associated with habitats atop the plateau and along the main streams. The badger occurs in expanses of grassland or sparse, low-growing shrubs. The mink prefers riparian woodlands and is likely to occur along the Colorado River. Raccoons, ringtails, striped skunks, and western spotted skunks probably also occur—raccoons and striped skunks mostly along the major drainages and spotted skunks and ringtails in canyons on the margins of the site.

Small mammals are important components of the local ecosystem. They provide a food source for predators, both actively and passively affect plant communities, and in some cases (e.g., the beaver) can have profound influences on the physical habitat. White-tailed jackrabbits and desert cottontails occur in semi-desert shrublands and grasslands at lower elevations. Rodents occurring on site include the beaver and muskrat along the Colorado River, porcupine in woodlands at all elevations, and several members of the squirrel family. The latter include the yellow-bellied marmot on talus slopes and rock outcrops; the red squirrel, golden-mantled ground squirrel, and least chipmunk along the cliffs; the rock squirrel and Hopi chipmunk in rocky areas and lower elevation woodlands; and the Wyoming ground squirrel and thirteen-lined ground squirrel in open grasslands and sparse shrubs in the lower elevations of the APF study area. The white-tailed prairie dog is present in arid grasslands and semi-desert scrub farther west but is not known to occur within the vicinity of the study area.

Other rodents observed or expected include the western jumping mouse in riparian wetlands and other widespread species such as the bushy-tailed woodrat (packrat), deer

mouse, canyon mouse, pinyon mouse, northern grasshopper mouse, long-tailed vole, and "Apache" pocket mouse. Non-rodent ground-dwelling small mammals documented or expected include Preble's shrew (CNHP 1997) and the masked shrew, montane shrew, dwarf shrew, and water shrew (Fitzgerald et al. 1994). Several bat species also occur or would be expected. These include five BLM sensitive species listed below as well as several more common species. Bats are likely to be associated with wooded areas atop the plateau, along the cliffs, and along major drainages, as well as alcoves, ledges, and caves along the Roan Cliffs. Raptor species hunt and nest within the APF study area. The Roan cliffs are sites for several known raptor nests.

Reptiles known or likely to occur within the APF study area include a number of lizards and snakes, including two snake species listed as sensitive. Amphibian species in the area include the tiger salamander in stockponds and other small reservoirs; the Great Basin spadefoot and northern leopard frog (both BLM sensitive species); and Woodhouse's toad in the vicinity of the Colorado River.

Given the physical and ecological conditions in the vicinity of the shale pile, it is unlikely that this area supports nesting or feeding habitat for any wildlife, with the exception of an occasional rodent or reptile.

2.8 Sensitive Species and Environments

2.8.1 Sensitive Species

BLM is directed to ensure that no action that requires federal approval should contribute to the need to list a species as threatened or endangered under the Endangered Species Act (ESA). This protection also applies to species that are proposed or candidates for listing and to species designated by each state director as sensitive.

A number of surveys, NEPA documents, and land health assessments have mapped and described occupied and potential habitat for a number of sensitive species within the vicinity of the APF (BLM 2000, 2002; CNHP 1997, 1998, 2001; Greystone 1995; TRW 1981). Specific to the APF, a number of federally listed or proposed species that may occur within a 4-mile radius of the APF were listed in a letter written from the U.S. Department of the Interior to the Environmental Technology Section of Oak Ridge National Laboratory on May 24, 1994.

A list of potential sensitive species for the APF study area was compiled from these studies. Species considered for inclusion in this assessment are known to occur within the APF study area or have a high likelihood of occurring based on habitat considerations and known geographic range and are listed in Table 2-1. Nomenclature follows current Colorado Natural Heritage Program (CNHP) lists.

Table 2-1: Potential Special Status Species, APF Study Area				
Common Name[1]	**Scientific Name**	**Status**	**Listing Agency**	**Primary Habitat or Location in Area**
FISHES				
Bluehead Sucker	*Catostomus discobolus*	Sensitive	BLM	Colorado River
Flannelmouth Sucker	*Catostomus latipinnis*	Sensitive	BLM	Colorado River
Razorback Sucker	*Xyrauchen texanus*	Endangered	USFWS	Colorado River
Humpback Chub	*Gila cypha*	Endangered	USFWS	Colorado River
Bonytail Chub	*Gila elegans*	Endangered	USFWS	Colorado River
Roundtail Chub	*Gila robusta*	Sensitive	BLM	Colorado River
Colorado Pikeminnow	*Ptychocheilus lucius*	Endangered	USFWS	Colorado River
AMPHIBIANS				
Great Basin Spadefoot	*Spea intermontana*	Sensitive	BLM	seasonal pools
Northern Leopard Frog	*Rana pipiens*	Sensitive	BLM	ponds and streams
REPTILES				
Utah Milk Snake	*Lampropeltis triangulum taylori*	Sensitive	BLM	woodlands and riparian areas
Midget Faded Rattlesnake	*Crotalus viridis concolor*	Sensitive	BLM	rocky, arid areas
BIRDS				
Bald Eagle	*Haliaeetus leucocephalus*	Threatened	USFWS	along Colorado River
American Peregrine Falcon	*Falco pergrinum anatum*	Sensitive	BLM	cliffs, rivers
Ferruginous Hawk	*Buteo regalis*	Sensitive	BLM	cliffs, open land
Columbian Sharp-tailed Grouse	*Tympanuchus phasianellus columbianus*	Sensitive	BLM	sagebrush, mountain brush/grassland
Barrow's Goldeneye	*Bucephala islandica*	Sensitive	BLM	lakes, rivers
White-faced Ibis	*Plegadis chihi*	Sensitive	BLM	marshes, shores
Greater Sandhill Crane	*Grus canadensis tabida*	Sensitive	BLM	marshes, fields
Loggerhead Shrike	*Lanius ludovicianus*	Sensitive	USFWS	open woodlands, low shrubs, grassland
Western Yellow-billed Cuckoo	*Coccyzus americanus occidentalis*	Candidate	USFWS	old-growth riparian forest
MAMMALS				
Spotted Bat	*Euderma maculate*	Sensitive	BLM	caves, cliffs, mine shafts, trees
Townsend's Big-eared Bat	*Corynorhinus townsendii pallescens*	Sensitive	BLM	caves, cliffs, mine shafts, trees
Fringed Myotis	*Myotis thysanodes*	Sensitive	BLM	caves, cliffs, mine shafts, trees

Table 2-1: Potential Special Status Species, APF Study Area				
Common Name[1]	**Scientific Name**	**Status**	**Listing Agency**	**Primary Habitat or Location in Area**
Yuma Myotis	*Myotis yumanensis*	Sensitive	BLM	caves, cliffs, mine shafts, trees
Big Free-tailed Bat	*Nyctinomops macrotis*	Sensitive	BLM	caves, cliffs, mine shafts, trees
PLANTS				
Parachute Penstemon	*Penstemon debilis*	Candidate	USFWS	sparsely vegetated south-facing talus (Green River Formation)
DeBeque Milkvetch	*Astragalus debequaeus*	Sensitive	BLM	restricted to Wasatch Formation soils
DeBeque Phacelia	*Phacelia submutica (Phacelia scopulina* var. *submutica)*	Candidate	USFWS	restricted to sparsely vegetated, steep slopes on clays
Southwest Stickleaf (Arapien Stickleaf)	*Nuttallia argillosa (Mentzelia argillosa) (Mentzelia rhizomata)*	Sensitive	BLM	restricted to steep talus or scree slopes derived from the Green River Formation
Utah Fescue (Sedge fescue)	*Argillochloa dasyclada (Festuca dasyclada)*	Formerly Sensitive	BLM	barren scree slopes on soils derived from oil shales

[1] Species in **bold** letters are Federally listed, proposed, candidate, or petitioned as threatened or endangered. All Federal threatened or endangered species are also State-listed by CDOW.

2.8.2 Sensitive Environments

Sensitive environments within the 15-mile in-stream segment of West Sharrard Creek and the other creeks present in the APF include 1,700 acres of critical habitat for various fish and bird species (ORNL 1994). However, none of this habitat occurs within the immediate vicinity of the shale pile. This lower reach supports a diverse ichthyofauna, including four species of federally listed Colorado River fishes, other native non-game fishes, and introduced game fishes. A number of sensitive or endangered bird species and bats are present that could potentially be impacted by contaminated surface water through ingestion of water or the aquatic food chain. Seasonal streams can be an important source of water for livestock as well as wildlife, including mule deer, and may be used for breeding by amphibians. Additionally, riparian vegetation may uptake contaminants from the shallow ground water associated with the stream, and any contaminants transported into some of the streams may be transported to the Colorado River or Fravert Reservoir. These latter two habitats support game fishes, nesting by a variety of water birds, and other terrestrial and aquatic wildlife.

The APF also includes habitat for several sensitive plants species, including the federally listed DeBeque milkvetch. Due to the inhospitable soil condition of the shale pile and impoundments, it is unlikely that any of the sensitive plants occur on these contaminated materials. Field observations made during May 2004 observed no sensitive plant species on the waste shale pile, impoundments, or plant area.

Sensitive wildlife habitats within the larger APF area include critical mule deer winter range, riparian corridors along ephemeral drainages, the Colorado River riparian corridor, the Colorado River aquatic habitat, Fravert Reservoir (see next paragraph), and any seasonal pools used for breeding by amphibians or as wildlife/livestock watering holes. Mule deer winter range includes most of the habitat types within and near the site. Riparian habitats along ephemeral drainages and the Colorado River receive disproportionate wildlife use throughout the year. Numerous species, including migratory birds present in the area only seasonally, concentrate in the relatively lush and structurally complex riparian habitat.

Fravert Reservoir is located approximately 6 miles to the east/northeast of the APF, near Rifle. Therefore it could only receive contamination from the APF via windblown dust. This is unlikely to be significant given that it is 6 miles downwind.

2.9 Meteorology

Climate in the region is generally considered semi-arid with an average annual precipitation of 11 inches, half of which is recorded during the winter months. Summer precipitation occurs almost entirely as localized thunderstorms, which can produce flash flooding. The mean daily maximum and minimum temperatures recorded for nearby Rifle, Colorado is 63.0 and 31.5 degrees Fahrenheit, respectively.

Table 2-2: Average Temperature, Wind and Precipitation at Rifle, Colorado*

Month	High Temperature, °F	Low Temperature, °F	Wind Speed and Direction, mph	Average Precipitation, inches
Jan	36.8	9.4	5.7 ESE	0.86
Feb	43.8	16.5	6.7 ESE	0.77
Mar	53.6	24.1	8.4 ESE	0.95
Apr	64.1	31.3	9.4 ESE	1.00
May	74.0	38.7	9.6 ESE	1.00
Jun	84.0	45.2	9.8 ESE	0.73
Jul	90.2	52.0	9.4 ESE	1.02
Aug	87.6	50.4	9.1 ESE	1.14
Sep	79.4	41.4	9.0 ESE	1.11
Oct	67.3	31.1	7.9 ESE	1.20
Nov	51.4	21.3	6.8 ESE	0.89
Dec	39.4	12.4	6.0 ESE	0.93
Annual	64.3	31.1	8.1 ESE	11.61

*Wind speed and direction from nearest station at Grand Junction, Colorado which may not accurately represent conditions at Rifle.

2.10 Previous Removal Actions

Previous removal actions at the shale pile and impoundments have been generally limited in scope and were performed when the APF was operational or during demolition of the Plant Site. No information is available about the amount of time or money spent on these previous removal actions, and no removal actions on the shale pile or impoundments were performed under CERCLA authority by the Bureau of Mines, Department of Energy, or BLM.

In response to releases of oil from the *in-situ* retorting that was occurring within the shale pile in 1979, a channel was constructed at the base of the shale pile to divert oily runoff to the Upper Process Pond. During decommissioning and demolition of the APF (1984-1986), approximately 700 barrels of oil were skimmed from the Upper Process Pond and transferred to tanks. All impoundments were also filled in with native soil between the mid-1970s and 1986. The course of West Sharrard Creek was altered to make room for the shale pile during operations, and work was also performed to prevent the shale pile from reaching the creek during plant operations.

In addition, current estimates of the volume of the shale pile are significantly less than what would be expected from approximately 400,000 cubic yards of raw shale which was processed at the APF (E&E 2004). Current estimates of the amount of material within the shale pile range between 70,000 and 130,000 cubic yards. Although no written documentation was available on this subject, it is believed that significant quantities of shale fines were used as road material within the APF. Virgona (personal communication, 2003) stated that tar from the APF refinery was used to pave the APF access road.